



# Quality

The tests were conducted by an independent certifying body

## Melt Mass Flow Rate Index (MFR)

**Test Method:** ASTM D1238: 2023

**Description:** Measures how easily a plastic polymer flows when it is heated. A sample of the material is melted, and the rate at which it flows under a specific pressure is recorded.

**Outcomes:** Plastics with a higher flow rate are typically easier to process and more consistent in production. The test helps in verifying production repeatability: if the MFR of one polymer batch differs from another, it may indicate differences in composition or manufacturing processes. It may also indicate polymer degradation: thermal or oxidative degradation of polymers tends to reduce their viscosity, leading to a modification in MFR.

**Results\*\* H-TEMP MFR medium: 7,85 g/10'** | No significant difference between the two types of plastic

## Izod Impact Strength Test

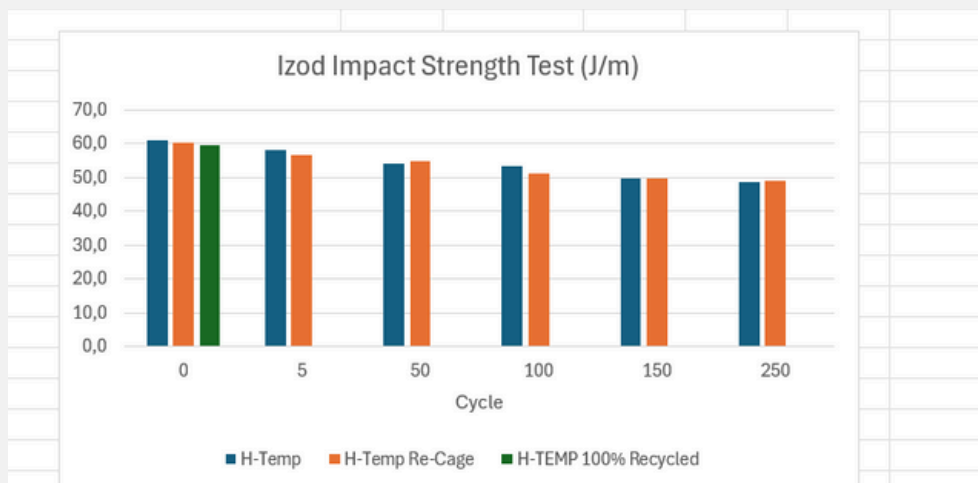
**Test Method:** ASTM D256: 2023

**Description:** Evaluates how well a plastic can withstand a sudden blow or impact without breaking. During the test, a notched sample of the material is struck by a hammer, and the energy absorbed before it fractures is measured.

**Outcomes:** A higher impact strength indicates the plastic is more resistant to cracking or breaking under stress. This results in products that are tougher, more durable, and better suited for applications where they might be exposed to impacts or rough handling.

The test can also be used as a tool to verify the material's quality and its structural condition.

**Results\*\*:** No significant difference between the two types of plastic



# Density Determination

**Test Method:** UNI EN ISO 1183-1: 2019

**Description:** Measures the mass of a plastic material in relation to its volume. Typically, the material is weighed, and its volume is determined using methods like water displacement or geometric calculations

**Outcomes:** A higher density means the material is heavier and more compact, while a lower density means it is lighter. Higher-density plastics tend to be stronger and more durable. It is a useful indicator for comparing different formulations of the same polymer or polymers with additives. By modifying the additives or the treatment/processing, the density can change, reflecting significant differences in physical and mechanical properties.

**Results\*\*:** H-TEMP Density medium ( $\rho$ ): 1,236 g/cm<sup>3</sup> | H-TEMP 100% Recycled Density medium ( $\rho$ ): 1,237 g/cm<sup>3</sup> | No significant difference between the two types of plastic

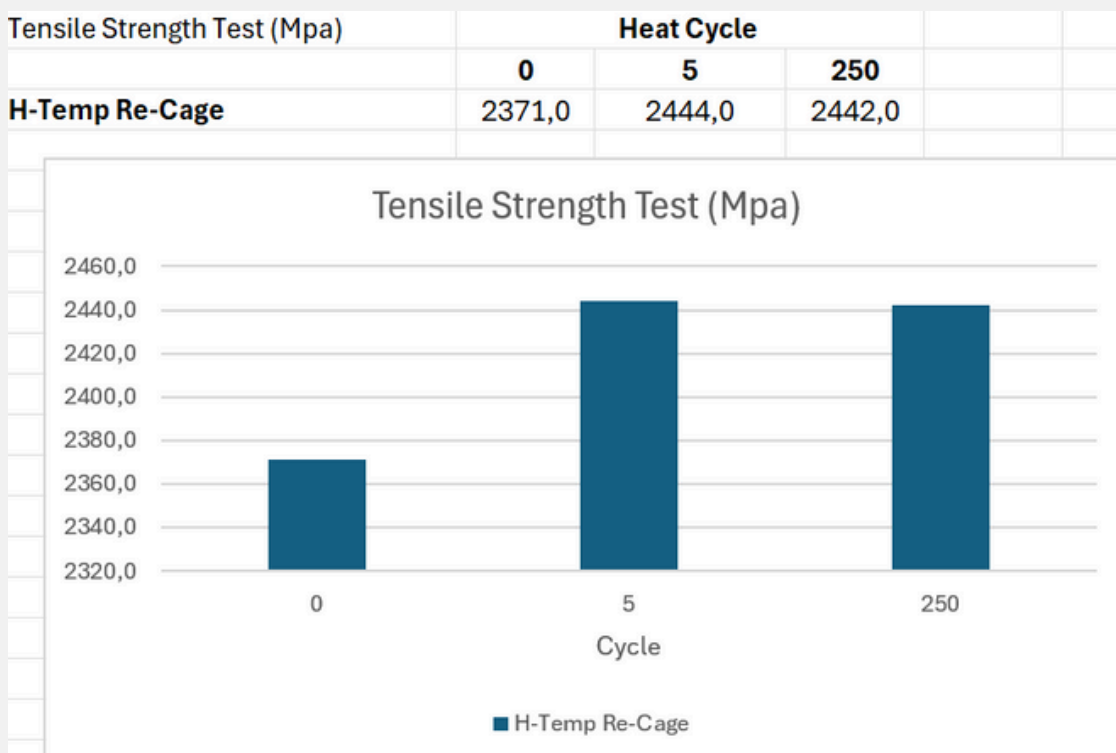
# Tensile elastic modulus (MPa)

**Test Method:** ASTM D638: 2022

**Description:** Measures how much force a plastic can withstand when being stretched before it breaks. The material is pulled until it deforms or snaps, and the test records the maximum force it can handle.

**Outcomes:** A higher tensile strength indicates the plastic is stronger and more resistant to stretching or breaking under tension. It also indicates polymer degradation: degradation induced by mechanical stress (post-processing) generally leads to a reduction in the tensile elastic modulus due to the breaking of polymer chains. The material's mechanical behavior therefore degrades, causing a reduction in long-term performance.

**Results:** H-Temp: 2480 mPa | No significant difference between H-Temp and H-Temp Re-Cage



## Heat Deflection Temperature (HDT) under Load

**Test Method:** ASTM D648: 2018

**Description:** Measures the temperature at which a plastic material deforms when subjected to a specific load. The sample is heated while a constant weight is applied, and the temperature at which it starts to bend or lose its shape is recorded.

**Outcomes:** A higher HDT indicates that the plastic can withstand higher temperatures without losing its structural integrity. This is crucial for applications where the material will be exposed to heat.

**Results\*\*:** H-TEMP: 178°C | H-TEMP 100% Recycled: 177 °C | No significant difference between the two types of plastic

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## DSC - Differential Scanning Calorimetry

**Test Method:** UNI EN ISO 11357-2: 2020

**Description:** Measures the heat flow into or out of a material as it is heated or cooled. This test provides information about the material's thermal properties, such as melting point, crystallization temperature, and glass transition temperature.

**Outcomes:** It is essential for understanding the material's stability, performance, and suitability for high-temperature applications, ensuring optimal product quality and durability. It is also an indicator of polymer purity, as contaminants can cause different thermal effects.

**Results\*\*:** H-TEMP: 185,9 °C | H-TEMP 100% Recycled: 186,9 °C | No significant difference between the two types of plastic

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## REACH

**Test Method:** REACH Regulation 1907/2006

**Description:** European regulation aimed at ensuring that chemicals used in products, including plastics, are safe for both human health and the environment. It requires manufacturers to provide detailed information about the chemicals in their products, assess potential risks, and ensure compliance with safety standards.

**Outcomes:** For plastic products, REACH ensures that harmful substances are controlled or restricted, leading to safer, more sustainable materials and helping companies meet environmental and regulatory requirements while protecting consumers.

**Results\*\*:** H-Temp 100% Recycled: None of the harmful substances exceed the limits set by the regulations

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## Global and Specific Migration in Aqueous Food Simulants by Immersion

**Test Method:** Food Contact (European Regulation)\*

**Description:** Measures how much of a substance migrates from a plastic material into an aqueous (water-based) food simulant when the material is immersed in it. Global migration is the total amount of all substances that can migrate from a material/object in contact with food to the food or its simulant. Specific migration is the amount of a specific substance that migrates from a material/object intended to come into contact with food to the food or its simulant.

**Outcomes:** The results help ensure that the plastic is safe for food contact, as the migration must stay within regulated limits set by health authorities. This test is crucial for ensuring that the plastic material does not release harmful substances into food, protecting consumer health

**Results\*\*:** H-Temp 100% Recycled: None of the harmful substances exceed the limits set by the regulations

# Head Space Screening Analysis

**Test Method:** Food Contact (European Regulation)\*

**Description:** Absence of NIAS (Not Intentionally Added Substances): detects and semi-quantifies volatile and semi-volatile organic compounds (VOCs and SVOCs) that may be present in a material. In this process, the plastic is heated in a sealed container, and the volatile substances that escape into the air (headspace) are analyzed.

**Outcomes:** This test helps identify potentially harmful chemicals that could migrate from the material into the environment, food, or products. By detecting these compounds, manufacturers can ensure their products meet safety standards, avoiding harmful emissions and ensuring consumer safety.

**Results\*\*:** H-Temp: No hazardous substances present | H-Temp 100% Recycled: No hazardous substances present

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# Solvent Extraction Screening Analysis

**Test Method:** Food Contact (European Regulation)\*

**Description:** Absence of NIAS (Not Intentionally Added Substances): detects and semi-quantifies semi-volatile and non-volatile organic compounds (SVOCs and NVOCs) in a material. In this process, the material is treated with a solvent that extracts these compounds, which are then analyzed.

**Outcomes:** It ensures that the material complies with safety standards by confirming that harmful or restricted chemicals are not present at levels that could pose a risk to consumers or the environment.

**Results\*\*:** H-Temp: No hazardous substances present | H-Temp 100% Recycled: No hazardous substances present

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# Total Extractables in Food Simulants According to FDA 21 cfr. parts 170 to 199 § 176.170

**Test Method:** Food Contact (FDA)\*

**Description:** Measures the amount of substances that may leach or migrate from plastic materials into food when in contact with food simulants (substances that mimic food, like water or oil). The FDA sets limits on how much of these extractable substances can migrate, ensuring that the plastic is safe for use in food packaging

**Outcomes:** By passing this test, plastic materials demonstrate they are safe for food contact, protecting consumer health and ensuring compliance with food safety regulations.

**Results\*\*:** H-Temp 100% Recycled: None of the harmful substances exceed the limits set by the regulations

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*\*= Although the product is not intended for food contact use, the relevant tests have still been carried out, as they are more stringent and aimed at excluding the presence of undesirable substances*

*\*\*= Although H-Temp Re-Cage contains a lower percentage of recycled plastic, the majority of tests have been carried out with H-Temp 100% Recycled, in order to create a more challenging experimental condition that ensures the product's quality*